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Expansion of the SEAMAP_C Fishery-Independent Sampling Program Overview Document

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1 Introduction

1.1 Fishery Independent Monitoring Research in the US Caribbean

The importance of establishing a long term standardized fishery monitoring program in the US Caribbean was recognized as early about 1986 (see Rosario 1993). Rosario (1989) stressed the critical need for fishery independent research for use in measuring fluctuations in abundance and in evaluating seasonality of major commercial fin fish species. Prior to this time, fisheries independent scientific research in Puerto Rico focused on identifying new fishing areas and implementing new fishing techniques and gears (Rosario 1993). Rosario (1989) carried out a preliminary fishery independent survey of commercially exploited reef fish resources off the north, northwest, west, and southwest coasts of Puerto Rico from April 1988 through June 1989. The 1988/1989 survey was also initiated partly in response to an observed decline in catch per unit of effort (CPUE) in the Puerto Rico trap fisheries, in response to an observed switch from a mainly 'trap' only fishery to a multi-gear fishery off Puerto Rico between 1968 and 1980, and to better evaluate a change in species composition observed by both fisheries agencies and fishers in Puerto Rico.

Rosario (1993) reported that efforts to construct a joint Puerto Rico and US Virgin Islands fishery-independent program, one in which sampling effort and methodology was standardized across the region, were initially planned for 1991; however, delays in funding hampered the survey beginning on time in the US Virgin Islands. The Southeast Area Monitoring and Assessment Program (SEAMAP) Caribbean component was implemented in 1992 in the US Virgin Islands however, some sampling on a smaller scale took place in the 1980's (see Beets 1993). Surveys from the earlier years are not directly comparable to the SEAMAP-C data since sampling design protocol and methods varied. It is important to note that SEAMAP is a cooperative State/Federal/University Program established for the collection, management, and dissemination of fishery-independent data and information in the southeastern United States and Caribbean.

1.2 SEAMAP Goals and Objectives (2006-2010)

As part of its internal review, the SEAMAP management reviews its objectives and accomplishments in order to refine and prioritize specific research needs. The 2006-2010 management Plan (Griffin 2005) identifies as its primary mission "to provide an integrated and cooperative program to facilitate collection and dissemination of fishery-independent information for use by government agencies, the fishing industry, researchers and others to enhance knowledge of marine fisheries and their associated ecosystems. The program lists five primary goals two of which pertain directly to fisheries research activities and are most relevant to this proposal. These are to: 1) collect long-term, standardized, fishery-independent data consistent with established fisheries data systems and 2) cooperatively plan and evaluate SEAMAP sponsored activities. The remaining three objectives relate to database operation, database identification and description, and program coordination and documentation and although

critically important to long term goals of SEAMAP, are not treated in this proposal. This proposal summarizes information from recent US Caribbean stock assessment evaluations and reviews of SEAMAP data. These evaluations and reviews suggest that the current SEAMAP data may not be providing managers the information needed for making reliable stock assessment evaluations of U.S. Caribbean reef resources. These evaluations and reviews suggest the need for re-analysis of the current sampling protocol and methodologies being used by SEAMAP-C.

2 Rationale and Need for Expansion of Current Surveys

2.1 Stock Evaluation Reviews

Recent reef fish stock assessment evaluations conducted within the Southeast Data, Assessment, and Review (**SEDAR**) cooperative Fishery Management Council process for several Caribbean reef fish stocks (http://www.sefsc.noaa.gov/sedar/), have raised concerns regarding the utility of using the SEAMAP fishery independent data for evaluating stock condition. In particular, concern has been raised that the current SEAMAP sampling program may not be meeting long term program objectives for the reef fish resources. Two cases in particular suggest the need for further examination of the sampling methodology for use in studying fluctuations in abundance.

The 2003 SEDAR4 evaluation of deep water snapper stocks (silk, blackfin, and queen) and the 2005 SEDAR8 Caribbean yellowtail snapper Assessment Workshop both explored the use of the current fishery independent data sets in providing information on stock condition. The SEDAR4 Data workshop panel reported the following as regards information from the current SEAMAP datasets for deep water snappers. "*Fishery-independent surveys in the U.S. Caribbean provide limited information on the four species of current interest (silk, queen, and blackfin snapper). Sampling effort is generally low in the U.S. Virgin Islands, with intermittent temporal coverage and small sample sizes in any given year. In Puerto Rico, there are years when sampling was far more extensive (i.e., 1992-94) however in general temporal coverage and low sample sizes precluded an analysis regarding trends. Trap sampling has consistently been more prevalent than handline sampling in both areas, but catch rates were higher for the four focal species in handline sampling. The current level of sampling effort in the U.S. Virgin Islands is low enough that the data may be of limited utility.*" The SEDAR4 Data Workshop recommended "*1) Encourage continued annual surveys throughout the area, 2) Determine the spatial/temporal coverage in fine detail, 3) data analysis and interpretation must address the temporal patterns observed in the size frequency distributions*" (http://www.sefsc.noaa.gov/sedar/download/SEDAR4_DW_Carib_Report.pdf?id=DOCUMENT). The SEDAR8 Caribbean yellowtail snapper Stock Assessment Workshop also considered the use of the fishery independent data in its deliberations to provide management advice to the Councils. The Consensus Summary Report prepared by the SEDAR8 Review Panel reported "*of the many research suggestions made, highest priority was assigned to the carrying out of fishery-independent surveys, the collection of more catch data, including specifically the recreational fishery, and the collection of age and length data*

from commercial and recreational catches and from fishery-independent surveys." In addition, the panel made specific recommendations as to fishery independent research needs that included: "1) *A new independent sampling regime to target yellowtail snapper more effectively should be created, because current methods do not allow temporal or spatial coverage, 2) Visual surveys can provide useful fishery-independent data. The methods would vary however, based on the depth of the insular shelf, and 3) the output of other existing studies (NOAA and non-NOAA) should be examined to see if alternative fishery-independent sampling already exists*" (http://www.sefsc.noaa.gov/sedar/download/S8RW_FinalConsensus.pdf?id=DOCUMENT).

2.2 Recent Scientific Reviews of SEAMAP-C data

In addition to evaluations by federal and state stock assessment groups (e.g., SEDAR), recent external evaluations by independent groups of scientists and through the SEAMAP committees have identified several concerns as to the applicability of the present data base for evaluating changes in reef fish stocks. Three recent reviews of the SEAMAP-C data for the US Virgin Islands further document concern that an evaluation of the present sampling methodology is needed.

In an analysis of the US Virgins data from 1992-2002, changes in CPUE between islands, gear types and over time were evident; however, patterns were not clear or consistent (Whiteman (2005). Whiteman suggested that a larger more comprehensive data set was needed to evaluate these observed changes in CPUE and/or that more importantly repeated sampling at the same location (station) and time (within season) was needed. Similar survey design changes were first recommended by Ault and Rothschild (1991) in evaluating the initial pilot survey conducted by Rosario (1989) and again by Smith and Ault (1993). These reviewers strongly suggested adding repeated samples at each station and, including into analysis factors associated with varying habitat or substrate type. Whiteman (2005) noted that, although several patterns in CPUE emerged from the data, that the continual presence of confounding variables (e.g., habitat type) and low sample sizes reduced the validity of trends. Whiteman's (2005) analysis suggested temporal changes in the composition of marketable catch and bycatch from traps; however, these changes could be also due to fishing effort changes between years as well as stations selected (i.e., location). In an earlier analysis, Beets (1983) noted the varying trends in CPUE both between regions and intra island and, further noted that a variety of factors could be at play, some confounding in the analyses such as fishing effort , habitat type, and gear construction (e.g., trap design-material, age, mesh). Whiteman's (2005) analysis suggested of temporal changes in size distributions was hampered by very low sample sizes. The lists of species captured however, did provide some information on the rarity of some species. Large serranids, such as Nassau groupers were not observed in St. Croix for either trap or hook and line. Off St. John, only three Nassau groupers were observed in 68 days of sampling; in general only small serranids such as red hind, coney and graysby were reported and a general lack of parrotfish was noted. Whiteman noted the importance of incorporating selectivity of the two fishing gears into analyses. Many of the reviewers noted the possibility of a lunar effect and also a seasonal effect (e.g.,

spawning vs. non-spawning) on CPUE and several studies discussed the variation in hook and line CPUE with individual experience and fisher ability.

Tobias (2002) provided summary information on surveys conducted in the US Virgin Islands from 2000 through 2002. From that report it was indicated that site selection was made independent of habitat. Post stratification of historical data carried out by earlier reviewers (see Ault and Rothschild 1991 and Smith and Ault 1993) documented the importance of incorporating habitat into site selection in order to reduce overall variability. In addition, Tobias (2002) documented that the recording of habitat identification was made using subjective methods. Other researchers have shown the importance of using habitat maps to aid in more accurately identifying specific habitat types.

In his review of the 1992-2000 US Virgin Islands data, Pagan (2004) provided a description of the dataset, identified substantial edits needed to correct much of the basic data records as to weight units, evaluated fishing effort and CPUE, and provided a GIS analysis of the fishing station habitats. Whiteman (2005) also commented on substantial editing that was required of the basic data prior to any rigorous analysis. In particular, station depths, although required to be recorded in fathoms were actually recorded in feet during some years. This type of hands on data verification requires much attention prior to incorporating into any type of analytical work. Whiteman also noted many inconsistencies in standardizing units of length used in the field (i.e., fork vs total). Pagan's analyses were made on a partially complete dataset representing 30 of 77 days sampled, but pointed out the need for quality control and the importance of clear definitions used in recording field information.

Quite clearly there exist concerns raised both by recent scientific stock assessment panel evaluations and from independent reviewers regarding the current fishery-independent sampling design and protocol being used for reef resources in the US Caribbean. These reviews and evaluations strongly support the need for a rigorous statistical analysis of the existing data to determine whether the surveys are collecting the information desired by managers and information critically needed in order to address a variety of questions pertaining to stock health. Any such analytical effort directed towards such a comprehensive evaluation of current survey design and protocols must necessarily take into consideration a thorough examination of current objectives and priorities of the SEAMAP-C program component specifically as related to reef resources in the US Caribbean. In addition, such an analytical effort must also assess to what degree the data being collected is meeting the objectives and mission of the program. This document briefly outlines a project aimed to address these concerns through two separate phases. The first phase briefly outlines an analysis to assess the current sampling design and protocol and a second phase of the project identifies specific details of expanding the current survey to address temporal and spatial limitations of the present survey.

2.3 SEAMAP-C Current Program Recommendations and Priorities

The 2005 SEAMAP Management Plan for the Caribbean component identified areas where three main areas where expansion of the current surveys was needed: 1) conch surveys, 2) lobster surveys and 3) trap and hook and line surveys. The SEAMAP-C committee also noted the limitations of the current data as documented by the SEDAR8 Stock Assessment Review Panel. In addition, the 2006-2010 SEAMAP-C Management Plan also noted that restoring current projects to original sampling effort was a priority for conch, lobster and trap and hook and line surveys. The committee also recommended that an evaluation of the current protocols be conducted to assure collection of statistically sound data for future use in stock assessment and management. The committee, in particular noted the inadequacy of both spatial and temporal sampling.

3 Proposed Project

The Southeast Fishery Science Center and MRAG propose to continue their collaborative work conducted in the US Caribbean by developing a project with a goal of developing a scientific evaluation of expanding the SEAMAP-C surveys. The project would be conducted in two phases. The objective of Phase I would be to evaluate and quantify the scientific validity of the current SEAMAP-C sampling design in terms of meeting management and stock assessment needs as identified by the SEMAP-C committee and by SEDAR assessments. As a part of Phase I, recommendations would be developed regarding any needed changes to the current sample design. Phase II of the project would take results from Phase I survey design analysis and apply through one or more pilot surveys. A brief overview of the elements and objectives within Phase I and II follow.

3.1 Phase I - Assess Statistical Validity of current SEAMAP-C sampling design and provide recommendations to produce a statistically robust sampling survey

A statistical evaluation of the current survey would be conducted by an independent statistician using the historical SEAMAP-C data. The analysis would include all available samples from Puerto Rico and the US Virgin Islands since the program's onset. A comprehensive evaluation of the sample data would be made within the context of assessing if the survey design in use meets the present mission and objectives of SEAMAP as identified in the 2006-2010 SEAMAP-C Management Plan. The analysis will take into consideration previous survey recommendations (e.g., Smith and Ault 1993 and Ault and Rothschild 1989), recent reviews (e.g., Whiteman 2004, Tobias 2004, Beets 1993, and SEDAR assessment evaluations) in evaluating if the data collections from the current design are providing reliable scientific information useful to managers for assessing stock condition with some level of confidence.

The research team has identified the following topics as an indicator of the types of analyses that may occur during Phase I:

I. Evaluate population fluctuations (e.g., CPUE changes) for Puerto Rico and for USVI reef resources – can changes be detected from the SEAMAP data, at what level (% change); what is the minimum change that the managers want to be able to detect?

   A. Overall for composite catch
   B. Overall by gear
   C. Fishery Management Units (FMU's) by gear (unit 1, unit 2 and so on)
   D. Individual species – e.g., key species and species of concern (Nassau, yellowfin grouper, red hind, coney, etc.)

II. Does current survey design allow for determination of parameters that can be used to evaluate overfishing status or just stock health

III. Assess minimal/optimal sampling allocation to meet topics I and II above.

The SEAMAP-C surveys were initially developed before ecosystem-based fishery management and essential fish habitat (EFH) became major issues within the fishery research and management arena. The goals and objectives of SEAMAP-C do not explicitly address these issues. While the SEFSC-MRAG research team will not presuppose how the SEAMAP-C committee may develop mechanisms to address these issues, the team will recognize their importance to both federal and state management.

The SEFSC-MRAG team would confer with SEAMAP-C members during development of a final proposal to assure that the project addresses the most pressing issues of the members and incorporates the most recent scientific information. The team recognizes the magnitude of the amount of work that could be done and the limited resources available for doing it. Therefore, the team will work with the committee to define the boundaries of a project with the minimum costs that would allow the committee to make informed decisions about future SEAMAP-C surveys.

A final report for Phase 1 will assess the level of survey coverage needed to provide data that will allow statistically robust conclusions to address the goals and objectives of SEAMAP-C and the terms of reference for SEDAR assessments. The statistical analyses would also determine whether the current survey design provides sufficient information to address fluctuations in population abundance of the primary management units as developed by the CFMC. Specifically, the "Final Rule for the Fisheries of the Caribbean, Gulf of Mexico, and South Atlantic; Comprehensive Amendment to the Fishery Management Plans of the U.S. Caribbean" calls for redefining fishery management units (FMU's) and sub-units and defining and establishing biological reference points and overfishing criteria. Statistical analyses carried out in Phase I will assess if the survey design provides for the collection of scientific data to evaluate the stock health of the CFMC CFRAMP management units with statistical robustness. The report will provide several alternative survey approaches with current and expanded funding levels, e.g., for a given level of funding, what level of surveys could the SEAMAP-C committee provide to obtain a specified level of accuracy and precision. The

report will provide an evaluation of gears currently or potentially used in the surveys from the standpoint of uncertainty in selectivity and suitability for assessing key stocks or FMU's.

3.2 Phase II –Incorporate Phase I results into pilot surveys to evaluate recommended changes and evaluate expansion of survey spatially and temporally

Phase II of the project would incorporate information gained from the Phase I statistical analysis to develop a series of pilot surveys. The objectives of these surveys would be to 1) incorporate any survey design changes into field work that would ultimately lead to more reliable statistical data collections and 2) test expansion of surveys to better meet SEAMAP and SEDAR objectives. Based on SEDAR recommendations for the US Caribbean, we have tentatively identified two pilot programs. While final selection of the pilot programs will come after conferring with the SEAMAP-C committee, these pilot programs allow for preliminary planning. The first pilot would be used to increase the geographical scope of the current shallow water reef fish survey in Puerto Rico to include the south coast and the southeast coast. A second pilot survey in Puerto Rico would address improving the habitat coverage from only shallow water reef fish resources to deep water, focusing on deepwater snapper resources. These two pilot surveys would also incorporate additional temporal resolution into the survey.

The SEFSC-MRAG team recognizes the importance of conch and lobster to the fisheries and economies of the US Caribbean. If, after the review and discussion of the Phase I results, the committee may prefer reprioritizing the focus of the pilot surveys. The research team will work with the committee to select the most important pilot projects. This could come by changing the shallow or deep water reef fish surveys to conch of lobster, or by adding additional pilot segments to the program. While logistics will limit the number of pilots conducted each year, planning could extend over several years and be revisited on an annual basis as to priorities and to intra year findings of each pilot. The US Caribbean is in general a data-poor region, with enhanced fishery-independent data identified as an important need for management and assessment. A medium- to long-term plan to assess and improve the data output from SEAMAP-C surveys will provide first steps toward meeting this need.

3.3 Project Team

The principle investigators for project team for the proposed evaluation and pilot survey project – Nancie Cummings and Robert Trumble – have worked together on previous projects in the US Caribbean (completed pilot observer projects for St. Croix and St. Thomas funded by CRP, and proposals for innovative stock assessments in Puerto Rico and the USVI currently under review). The team will also include Robert Wakeford and Edgardo Ojeda. Short summaries of the qualifications of the team follow.

Ms. Nancie Cummings, a federal research fishery biologist with 26 years of experience, has worked in a variety of fisheries environments including marine, estuarine and

anadromous. She holds a Master of Science in Fisheries Population Dynamics from the University of Washington, in Seattle, Washington, 1986. Ms. Cummings began her tenure with NOAA, NMFS, SEFSC in 1983 and since has been involved primarily in fisheries stock assessment analyses of king and Spanish mackerels, tunas, shrimp, and reef fish stocks. Ms. Cummings also worked as a biometrician working with salmonid stocks for the Quinault Indian Nation, Taholah Washington, 1987-1988, and as a biological technician for the South Carolina Department of Fisheries, Charleston, South Carolina, 1978-1980. Her current main work with the NMFS, SEFSC, Sustainable Fisheries Division includes documenting and quantifying what are major problems within several fisheries sampling program that impact analytical assessments and to work towards making improvements in this area. Currently Ms. Cummings is the lead assessment scientist responsible for developing fisheries catch and bio-statistical sample databases and conducting analyses of the U.S. Caribbean reef fish fisheries. As a NMFS assessment biologist Ms. Cummings conducts analyses often as member of a team as well as alone. Ms. Cummings has participated in the review, planning and evaluation of several of the important fishery sampling programs of the NMFS, SEFSC. Through her work with NMFS, Ms. Cummings has extensive experience working with other government agencies (state, international commissions), various fishery constituents (recreational and commercial) and external scientific panels and advisory teams. Recently she has been involved in several collaborative NOAA, Cooperative Research projects involving shallow water snapper genetics and bycatch studies in the US Caribbean. Ms. Cummings has written several peer-reviewed papers, presented scientific work at international and US scientific meetings, and participated in workshops.

Robert J. Trumble has wide-ranging experience in marine fish science and management, fishery habitat protection, and oceanography. Dr. Trumble joined MRAG Americas in 2000 as a senior research scientist and became Vice President in 2005. Previously, he served 14 years as Senior Biologist of the International Pacific Halibut Commission in Seattle, Washington, 10 years in various research and management positions at the Washington Department of Fisheries, and six years with the US Naval Oceanographic Office. At MRAG, Dr. Trumble performs project planning, assembles research teams, and conducts research, with a focus on improving management of aquatic ecosystems and the resources and fisheries they support. He is responsible for the development and management of the core business areas and functions of the company, senior oversight on major projects, and development of new business. His projects have included preparation and review of fishery management and habitat management plans, review of technology to support or replace on-board observers, provision of observer services, development of bycatch management and control, preparation of environmental assessments and environmental assessments, and conducting workshops on fishery issues. Dr. Trumble has extensive experience working with government agencies, commercial and recreational fisheries groups, Indian tribes, and national and international advisory groups. He received appointments to the Scientific and Statistical Committees of the South Atlantic Fishery Management Council and the Pacific Fishery Management Council, the Groundfish Management Team of the North Pacific Fishery Management Council, the affiliate faculty of Fisheries at the University of Washington, and the Advisory Committee of the Washington Sea Grant Program. Dr. Trumble has published

in peer-reviewed journals and symposium proceedings, presented invited papers at national and international meetings, and written reports for government agencies. Dr. Trumble received a B.S. degree in Oceanography from the Department of Oceanography, University of Washington, an M.S. degree in Fisheries from the College of Fisheries, University of Washington, and a Ph.D. in Fisheries from the College of Fisheries, University of Washington.

Robert C. Wakeford joined MRAG Americas in 2006 as Technical Director, after 11 years working for MRAG Ltd. in London. Dr. Wakeford brings to the Group a broad range of multi-disciplinary skills within fisheries resource management and policy, ranging from fish stock assessment, survey design and analysis, statistical and empirical modeling, database design and project management. He was awarded his doctorate degree from Imperial College London in 2000, following a bio-socio-economic study to develop alternative management strategies for the Seychelles artisanal fishery, Indian Ocean. His experience with stock assessment and fisheries management extends from high latitude industrial fisheries, such as those within Europe and the South Atlantic, to artisanal fisheries mainly within the Caribbean and Indian Ocean. Dr. Wakeford has provided technical advice to the South Atlantic Fisheries Commission on the status of shared squid and finfish stocks between Argentina and the Falkland Islands, and has contributed to the ICES and CCAMLR Fish Stock Working Groups. Dr. Wakeford has gained extensive experience in the design and implementation of a range of resource survey methods. These include baseline dive surveys, socio-economic, ecological, and acoustic surveys for biological and fish stock assessment purposes. He has a strong analytical background, from which he can develop a range of sophisticated statistical and empirical models, where needed. His acute analytical skills are coupled with an ability to develop comprehensive data manipulation and analytical routines, including the development of database and VBA applications. More recently, Dr. Wakeford has developed a range of skills concerned with fisheries monitoring, control and surveillance, with particular emphasis on controlling illegal, unreported and unregulated fishing.

Edgardo Ojeda [Biography]

3.4 Proposed Time Frame

Currently, the condition of many of the reef resources in the US Caribbean is thought to be either unknown or in a serious decline. Thus, the importance of improving any long term monitoring program can not be understated. Even with the consideration of serious budget restrictions that are ongoing, implementing a rigorous and comprehensive statistical evaluation of the present fishery independent sampling program such as outlined briefly in Phase I, is urgently needed. It is the hope that this phase could be initiated during 2007 calendar year. Pending the results of Phase I and a thorough review of the Phase I survey design recommendations by all cooperators involved (program changes evaluation), we recommend that Phase II pilot survey planning should begin within one half year of the completion of Phase I, and that the first pilot survey should begin within one year of Phase I completion. In summary we suggest that Phase I Statistical Evaluation could be initiated during the latter half of 2007 calendar year, Phase

II Pilot surveys planning work could begin winter 2008, and the first pilot survey initiated by winter 2009.

3.5 Indicative Budget and Possible Sources of Funding

Due to uncertainties in the number and type of analyses that might be considered by the team in collaboration with the SEAMAP-C committee, as identified in Phase I, an indicative budget has been estimated to account for a range of options. Using the tasks outlined in section 3.2 above as a guide, a preliminary indicative budget between **$25,000** and **$40,000** would be appropriate depending on the number of species and/or detailed questions analyzed. The exact cost would be determined following further discussion with the SEAMAP-C Committee and the Project Team. In addition, realistically there would be some cost, unknown at this point, associated with preparing the data for analysis to insure previously documented quality control issues associated with data quality were not carried over into the actual statistical analysis. Costs associated with Phase II of the study have not been given at this preliminary stage and would as expected be dependent on a variety of factors including number of pilots, time duration, logistics and a number of other components that the team will address with the Committee.

There are several potential sources of funding available. Since the proposal is designed within two Phases, separate funding may be sourced for each or combined. For example, the SEAMAP-C program may be a suitable donor to fund the review in Phase I, while a grant from the NOAA, Cooperative Research Program (CRP) could potentially provide one or more of the pilot studies in Phase II either singly or in conjunction with existing SEAMAP-C program funds.

4 Conclusions

SEDAR assessments of US Caribbean fishery resources have yielded incomplete results to date because of lack of data. The current trend of incomplete information base will continue if current survey limitations are not rigorously evaluated and are not addressed, to the detriment of assessment and management required in the region. Clearly the use of fishery dependent data in the US Virgin Island to effectively manage reef fish resources has been shown to be fraught with problems (SEDAR8 Consensus Review). Rosario (1993) emphasized the importance of fishery information independent of the commercial fishery to aid in the evaluation of population fluctuations. Fishery-independent research has been ongoing in Puerto Rico since 1988 and in the US Virgin Islands since 1992. Throughout both regions, concerns for declining reef fish resources support the need of long-term comprehensive collaborative research programs that allow observed changes to be evaluated with statistical rigor and that allow replication in results.

References

Ault, Jerald S. and Brian J. Rothschild. 1991. Statistical sampling design analysis of the Puerto Rico fishery-independent survey. Final Report submitted to SEAMAP-

Caribbean Program and Caribbean Fishery Management Council dated May 15, 1991, 28pp, 5 Tables, 2 Figures plus Appendices.

Beets, Jim. Fisheries independent trap sampling in the U.S. Virgin Islands

Reef Resources Work Group. 1992. SEAMAP-Caribbean Reef Resources Survey Project. Fisheries – Independent Survey and sampling strategies. Working Draft. Prepared by the RRWG, revised by the RRWG July 23 1992, 8pp.

Griffin, Elizabeth. 2005. Draft Southeast Area Monitoring and Assessment Program (SEAMAP) Management Plan: 2006-2010. Prepared for Caribbean SEAMAP Committee, south Atlantic Board, Atlantic States Marine Fisheries Commission and Technical coordinating Committee, Gulf States Marine Fisheries Commission. 110 pp.

Rosario Jimenez, Aida. 1993. Shallow-water reef fish monitoring Caribbean/NMFS Cooperative SEAMAP Program. FRL Annual Rpt. to DNR, dated December 1993, 33pp + 3 Tables.

Rosario Jimenez, Aida 1989. Fisheries-independent monitoring of commercially exploited reef fish and spiny lobster resources in Puerto Rico. Completion Report. Submitted by Yvonne Sadovy, Director, Fisheries Research Laboratory, CODREMAR November 1989, 114pp.

SEAMAP-Caribbean 1990. Fishery independent data base directory, SEAMAP-Caribbean. November 1990. Draft document 44 pp. [Apparently a final draft was published in 1991.

SEDAR4 Deepwater Snapper Data Worshop. 2003. http://www.sefsc.noaa.gov/sedar/Sedar_Workshops.jsp?WorkshopNum=04

SEDAR8 Caribbean Yellowtail Snapper Consensus Review. 2005. http://www.sefsc.noaa.gov/sedar/Sedar_Workshops.jsp?WorkshopNum=08%20A

Smith, Steven G. and Jerald S. Ault 1993. Statistical sampling design analysis of the 1991-1992 Puerto Rico shallow-water reef fish monitoring survey. Final Report submitted to SEAMAP-Caribbean Program by the Rothschild Ault Group and Caribbean Fishery Management Council dated February 11, 1993, 36pp plus Appendices (A-E, 20pp.).